AMS Short Course

Fundamentals of Boundary Layer Wind and Temperature Profiling Using Radar and Acoustic Techniques

INTRODUCTION

February 8 & 9, 2003

Short Course Organizers

Dan Wolfe, Bob Baxter,
Paul Fransioli, Kevin Durkee

AMS COMMITTEE ON MEASUREMENTS

Daniel E. Wolfe, Chairperson
John A Augustine, Stephen A Cohn, Kevin R. Durkee,
Paul M. Fransioli, Donald E. Lehrman, Kenneth G. Wastrack,
Tammy M. Weckwerth, Allen B. White,
and Ex Officio: Gennaro H. Crescenti and Robert A. Baxter

Short Course Topics and Instructors

A Brief Overview

Saturday Morning Sessions
February 8, 2003

Introduction to Boundary Layer Profiling Technology

Introduction to Radar Wind Profilers and Radio Acoustic Sounding System Technology

George L. Frederick
Vaisala Inc.
Boulder, Colorado

February 8, 2003
8:15 – 9:45 a.m.

George Frederick

- Retired as Commander of the of the Air Weather Service after 30 years in the U.S. Air Force
- General Manager, Wind Profiler Business Unit, Vaisala Inc.
- Instrumental in the development of commercial radar wind and temperature profilers during past 12 + years
- 1999 American Meteorological Society President
- 2003 Recipient of the AMS Charles Franklin Brooks Award for “outstanding service as president and leadership in promoting economic growth across all sectors of the Society”

Acoustic Remote Sensing using SoDAR Technology

Kenneth H. Underwood, Ph.D., C.C.M.
AeroVironment Inc.
Monrovia, California

February 8, 2003
10:15 – 11:30 a.m.

Ken Underwood

- Long leadership in the development and applications of acoustic remote sensing systems
  - Including recent wind turbine, aircraft operation & wake effect studies
- Developed early Phased-Array SODAR antennas with XonTech in 1980s
- Installed, operated and managed data from numerous SODAR systems in support of field studies and other projects throughout the world
- Chief Meteorologist & Director of the Atmospheric Systems Group, AeroVironment Inc. (since 1988)
- Past Chair (1989-90), AMS Committee on Measurements

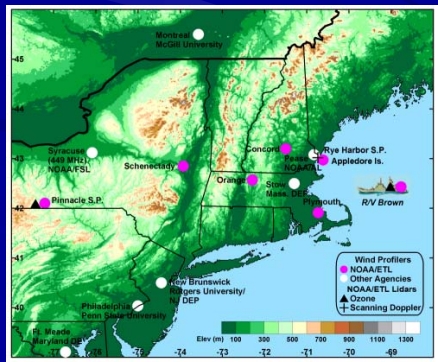
Luncheon Presentation
(Lunch Provided)

Current Profiler Networks, Future Needs and Plans

F. Marty Ralph, Ph.D.
National Oceanic and Atmospheric Administration
Environmental Technology Laboratory
Boulder, Colorado

Marty Ralph

- Chief of the NOAA/ETL Regional Weather and Climate Applications Division
- Extensive research utilizing profiler data to understand atmospheric phenomena
- A main force behind several large multi-disciplinary field research programs that have promoted the application of profiling systems and the state-of-the-science
  - California Land-Falling Jets Experiment (CALJET)
  - Pacific Jet Experiments (PACJET)
  - New England Air Quality Studies (NEAQS)



Saturday Afternoon Sessions
February 8, 2003

Operational Considerations

RADAR
Siting Considerations, Interference Sources, Installation and Maintenance

Clark W. King, Ph.D.
NOAA Environmental Technology Laboratory
Boulder, Colorado

February 8, 2003

1:30 – 2:15 p.m.

Clark King

- Meteorologist, NOAA ETL, Regional Weather and Climate Applications Division in Boulder, Colorado
- Expert in siting and operational aspects of weather instruments throughout the world, especially radar wind profilers
- Field Project Manager (most with profiler component)
  - Including Denver Brown Cloud Study, Denver CO Studies, Atmospheric Studies in Complex Terrain Experiments, Front range Air Quality Study, Mexico City AQ Study, California Transport Assessment Study, PACJET, SCOS97, CRPAQS, CCOS, NEAQS, …
- Research work in air pollution, boundary layer processes, and Instrumentation

SODAR
Siting Considerations, Interference Sources, Installation and Maintenance

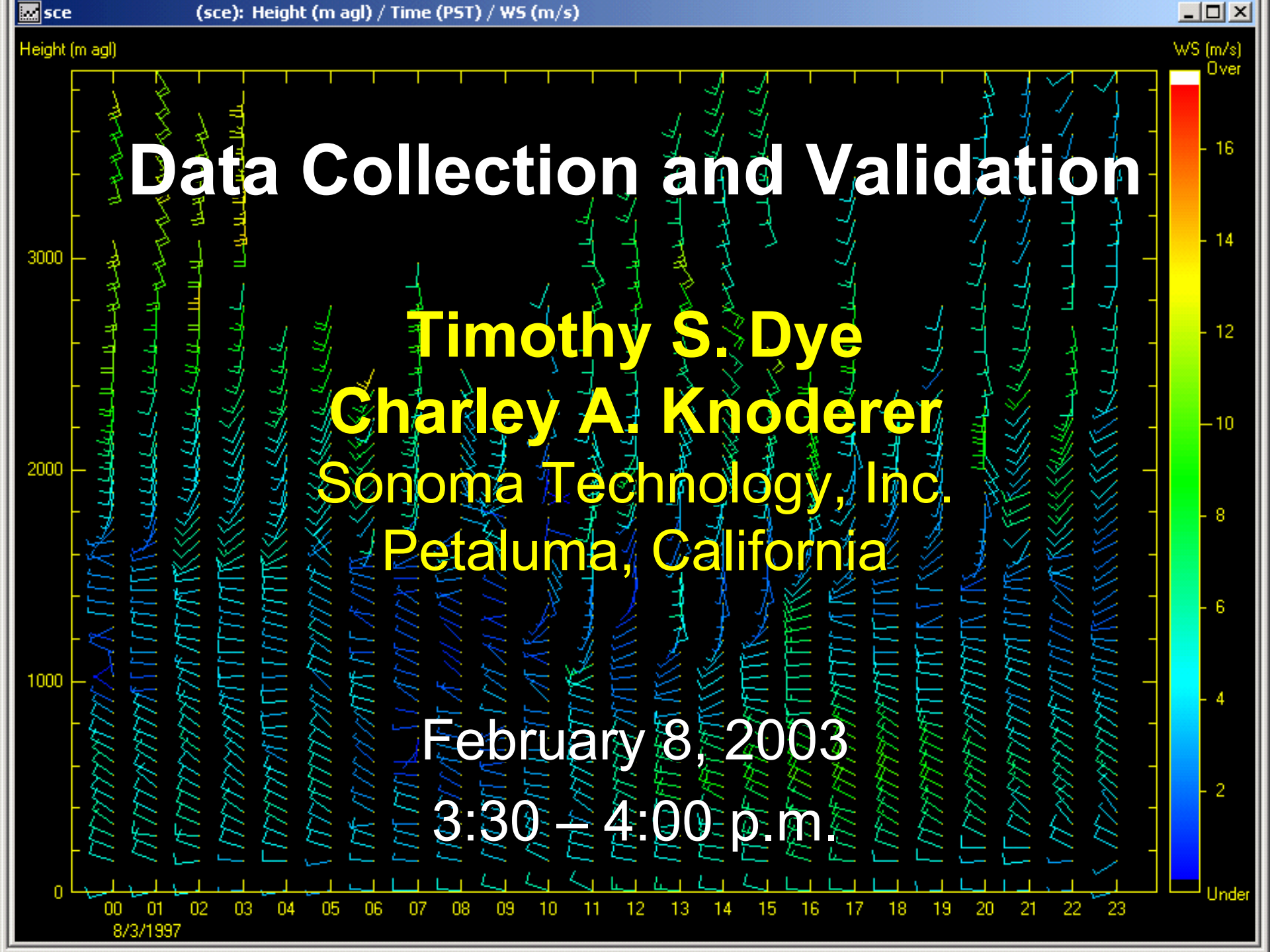
Jerry H. Crescenti
NOAA Air Resources Laboratory
Field Research Division
Idaho Falls, Idaho

February 8, 2003

2:15 – 3:00 p.m.

Jerry Crescenti

- Research Meteorologist, NOAA Air Resources Lab
- Significant contributions to meteorological measurements field, especially as related remote sensing and in-situ measurements aloft with aircraft
- Worked with US EPA to develop the PAMS upper air measurement requirements
- Involved in several major studies related to air quality
- Past Chair, AMS Measurements Committee (1998 - 2001)



Data Collection and Validation

Timothy S. Dye
Charley A. Knoderer
Sonoma Technology, Inc.
Petaluma, California

February 8, 2003
3:30 – 4:00 p.m.

Tim Dye

- General Manager for Meteorological Systems at STI
- Responsible for STI radar wind profiler business area, including profiler software development, field installations, training and data management
- Has planned, installed and managed over 40 RWP installations since 1990 for numerous field projects
- Manages STI air quality mapping and forecasting programs, including the redesign of EPA's AIRNOW software
- Authored US EPA PAMS guidelines for quality assurance and management of upper air data

Wind Profiler Signal Processing: Current and Future Technologies

Daniel E. Wolfe
NOAA Environmental Technology Laboratory
Stephen A. Cohn, Ph.D.
NCAR Atmospheric Technology Division
Boulder, Colorado

February 8, 2003
4:00 – 4:30 p.m.

Dan Wolfe

- Deputy Division Chief of the Clouds, Radiation and Surface Processes Division at NOAA/ETL
- Site Manager, Boulder Atmospheric Observatory
- Key to the development of radar wind profiler signal post-processing techniques to improve data retrieval and the understanding of atmospheric phenomena
- Worked on numerous field research projects comparing instrumentation and utilizing upper air measurements
- Developed and operated profiling systems for extreme conditions
  - Integrated Mobile Profiling System (MPS)
  - Arctic Leads Experiment (LEADEX)
  - South Pole
- Current Chair, AMS Committee on Measurements

Steve Cohn

- Scientist with the National Center for Atmospheric Research, Atmospheric Technology Division, Research Technology Facility
- Associate Editor, Journal of Applied Meteorology
- Extensive analysis and research related to meteorological measurements, including signal processing from Lidar, Radar and aircraft applications
- Broad experience with NCAR field programs
- Current Member, AMS Committee on Measurements

QUALITY ASSURANCE

Robert A. Baxter, CCM
Technical and Business Systems, Inc.
Valencia, California

February 8, 2003
4:30 – 5:00 p.m.

Bob Baxter

- Senior Scientist/Program Manager with Technical & Business Systems Inc., managing the Southern California Office
- Broad career centered on meteorological & environmental measurements and quality assurance
  - Developed innovative procedures for auditing RWP/RASS & Sodar systems
  - Co-authored the US EPA Draft Guidelines for the Quality Assurance and Management of PAMS Upper-Air Meteorological Data, now part of the EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications
- Integral to many field research projects,
  - Including the recent Las Vegas CO saturation study, SCOS97, California Regional Particulate Air Quality Study (CRPAQS), & Central California Ozone Study (CCOS)
- Past member, AMS Committee on Measurements

Sunday Morning Sessions
February 9, 2003

Profiler Observations, Applications and Analyses

Boundary Layer Profilers for Regulatory Applications

Kevin R. Durkee
South Coast Air Quality Management District
Diamond Bar, California

February 9, 2003
8:00 – 8:45 a.m.

Kevin Durkee

- Air Quality Specialist, South Coast Air Quality Management District, Meteorology & Modeling Section
- Operational forecasting, data analysis and modeling for air quality purposes
- Manages upper air measurements program for SCAQMD
- Technical Advisory Committees
  - Southern California Ozone Study (SCOS97)
  - Photochemical Assessment Monitoring Stations (PAMS) Program
  - CAPCOA Air Monitoring Committee on Meteorological Measurements
- Current member, AMS Committee on Measurements

Profiler Observations, Applications & Analyses - Weather Phenomena

Wayne M. Angevine, Ph.D.
NOAA, Aeronomy Laboratory
Allen B. White, Ph.D.
NOAA, Environmental Technology Laboratory
Boulder, Colorado

February 9, 2003
10:00 – 11:30 a.m.

Wayne Angevine

- Research Scientist, Cooperative Institute for Research in Environmental Sciences (CIRES), NOAA, Aeronomy Lab
- Registered Professional Engineer (Electrical & Computer)
- Research interests:
  - Atmospheric boundary layer physics and dynamics of coastal and transitional zones,
  - Instrumentation & remote sensing,
  - Regional air quality & mesoscale meteorological modeling
- Wide-ranging experience with environmental field studies
  - New England AQS (2002), Texas AQS (2000), Southern Oxidant Study (1999), …
- Current Member, AMS Committee on Boundary Layers and Turbulence

Allen White

- Research Scientist, Leads the Coastal Weather & Air Quality Group at NOAA/ETL, Regional Weather and Climate Applications Division
- Extensive analytical research associated with boundary layer measurements, air quality and coastal measurements
  - Including vertical ozone variations, integrated shipboard measurements, cloud microphysics validation, gravity waves & clear air turbulence, orographic rainfall, radar signal processing techniques
- Participation in several field research projects
  - Including PACJET, CALJET, NEAQS
  - Management of Texas-2000 Air Quality Study & 1999 Southern Oxidant Study
- Current Member, AMS Committee on Measurements

Sunday Afternoon Sessions
February 9, 2003

Profiler Observations, Applications and Analyses (continued)

Profiler Observations, Applications and Analysis – Derived Products

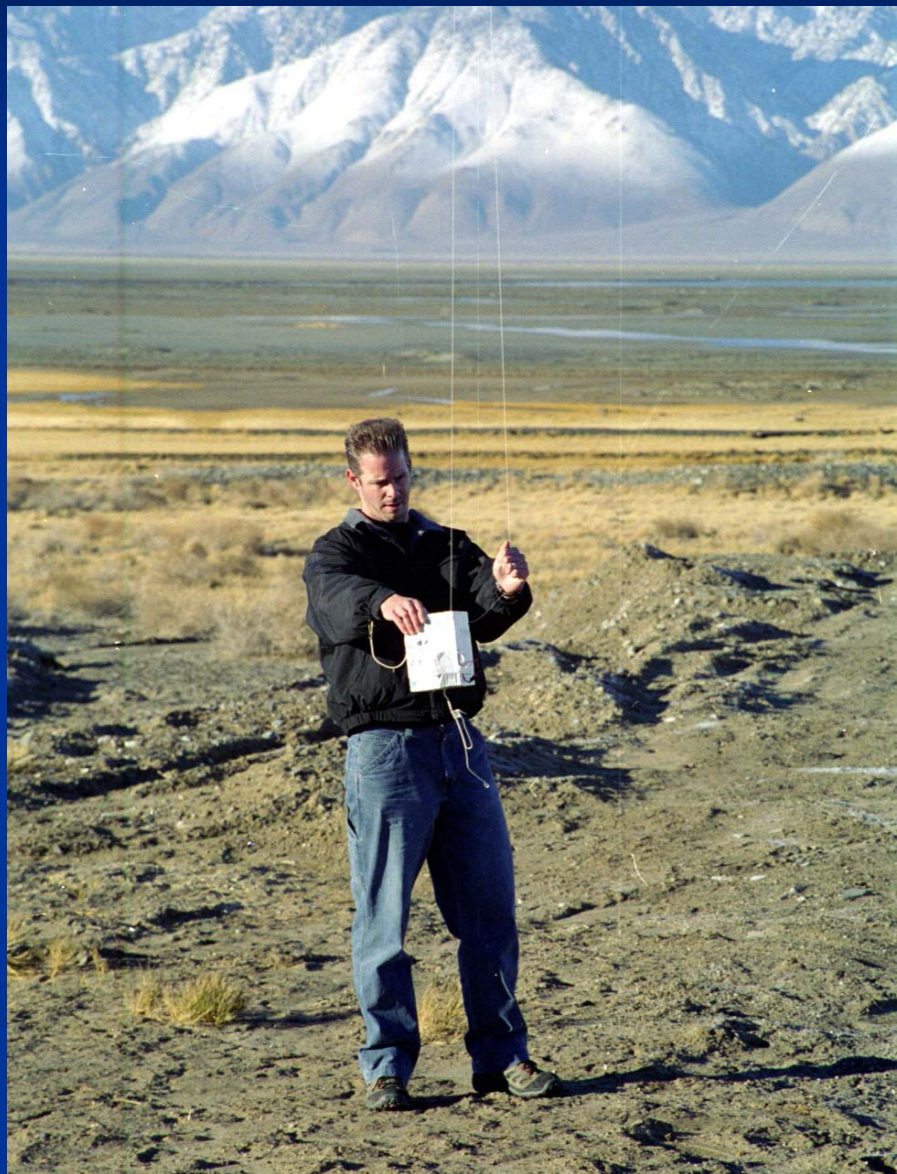
Clinton P. MacDonald
Timothy S. Dye
Sonoma Technology, Inc.
Petaluma, California

February 8, 2003
3:30 – 4:00 p.m.

Clinton MacDonald

- Meteorologist and Project Manager at STI since 1996
- Focus on meteorological and air quality data analysis and forecasting
- Developed air quality forecasting tools for several areas & co-authored US EPA guidance on ozone forecasting
- Managed field research, modeling & data analysis for several large air quality and planetary boundary layer studies,
  - including the Southern California Ozone Study (SCOS97), San Antonio Ozone Study, NARSTO-NE, San Joaquin Valley Integrated Monitoring Study, …

Balloon Soundings



Upper Air Instruments

Comparison of Upper Air Instruments

System	Variables	Approx. Frequency	Height Range (km)	Resolution (m)
Balloon-Borne Soundings	WS, WD, T, RH, T_d, p, mixing height		5 – 50	p, T, T_d, RH: 5-10, Winds: 45-75
Mini-SODAR	WS, WD, u, v, w	3-5 kHz	<0.3	5 - 20
Standard SODAR	WS, WD, u, v, w, turbulence, mixing height	1-3 kHz	<2	20 - 50
Mega-SODAR	WS, WD, u, v, w, turbulence, mixing height	<1 kHz	<5	100 - 200
Boundary Layer Radar Profiler	WS, WD, u, v, w, mixing height	915 MHz 449 MHz	<5 <10	60 - 200
RASS	T_v	2 kHz	<2	60 – 200

Where WS = wind speed; WD = wind direction; u, v, and w are the east-west, north-south, and vertical components of the wind, respectively; T = dry bulb air temperature; T_d = dew point temperature; T_v = virtual temperature; RH = relative humidity; and p = pressure. (Source: US EPA, 1997: PAMS Data Analysis Workshop Workbook. http://www.epa.gov/air/oaqps/pams/analysis/)

Introduction of Course Participants

- Name
- Affiliation
- Interests

Course Goals

- Promote better understanding of radar and acoustic profiling techniques.
- Encourage open discussion and dispersion of knowledge within the profiler community.

Open Discussions

After each morning
and afternoon session
(½ Hour)

All course instructors and attendees are encouraged to participate